House of Representatives

Committee on Science and Technology

Subcommittee on Space and Aeronautics

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Hearings on

Near-Earth Objects (NEOs) – Status of the Survey Program and Review of NASA's Report to Congress

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Mr. Chairman and Members of the Committee. It is an honor to be asked to testify before you today on this important subject. By way of identification, I am an astrophysicist and professor of physics at the University of California, Davis, and director of the Large Synoptic Survey Telescope (LSST) project; before coming to UC Davis four years ago I did research and development at Bell Labs for 34 years.

The house committee on science has been a leader on a bi-partisan basis for over two decades in focusing attention on the need to detect, characterize, and catalog near- Earth asteroids. The passage of the "George E. Brown Jr. Near Earth Object Survey Act" was a landmark piece of legislation that sets a goal of cataloging 90% of NEOs of 140 meters in diameter and larger within 15 years. The Committee is properly looking at the existing and future capabilities for carrying out this goal and expanding the existing Spaceguard program. LSST adopted the goal of surveying NEOs at the outset as one of its major science capabilities. I have attached to this statement a nine page summary of the capabilities of the LSST for detecting NEOs and obtaining their orbits.

Until recently, the discussion of risk associated with an impact of a NEO has been statistical; what is the probability? This is similar to considerations of risk in many other areas such as weather and traffic accidents. What if it were feasible to deploy a system that would alert me of an impending traffic accident well in advance? That would change the very nature of that risk from a probabilistic worry to a deterministic actionable situation. The ability to detect virtually every potentially hazardous Near-Earth object and determine its orbit with precision transforms that statistical threat into a deterministic prediction. We face many threats, and virtually all of them are either so complex or unpredictable that they are treated probabilistically even though the social and financial consequences are legion. With a comparatively small investment the NEO risk can be transformed from a probabilistic one to a deterministic one, enabling mitigation.

Ground-based optical surveys are the most cost effective tool for comprehensive NEO detection, determination of their orbits and subsequent tracking. (Radar also plays an important role once a threatening NEO has been found, in refining its orbit when the NEO is near.) The first job is to find the NEOs which are potentially hazardous (so-called Potentially Hazardous Asteroids) from among the swarm of ten million other asteroids. A survey capable of extending these tasks to NEOs with diameters as small as 140 m, as mandated by Congress, requires a large telescope, a large camera, and a sophisticated data acquisition, processing and dissemination system. This Congressional mandate drives the requirement for an 8-meter class telescope with a 3000 Megapixel camera and a sophisticated and robust data processing system. These requirements are met by the LSST.

The LSST is currently by far the most ambitious proposed survey of the sky. With initial funding from the US National Science Foundation (NSF), Department of Energy (DOE) laboratories and private sponsors, the design and development efforts are well underway at many institutions, including top universities and leading national laboratories.

Fortunately, the same hardware and software requirements are driven by science unrelated to NEOs: LSST reaches the threshold where different science drivers and different agencies (NSF, DOE and NASA) can work together to efficiently achieve seemingly disjoint, but deeply connected, goals. This broad range of science has earned LSST the endorsement of a number of committees commissioned by the National Academy of Sciences. Because of this synergy the Congressional mandate can be reached at only a fraction of the cost of a mission dedicated exclusively to NEO search.

We have carried out over 100 simulations of the LSST operations for a variety of NEO-optimized scenarios. The planned LSST baseline survey cadence on the sky, simultaneously optimized for all main science drivers, is capable of providing orbits for 82% of NEOs larger than 140 meters after 10 years of operation, and is 90% complete for objects larger than 230 meters. This baseline cadence assumes that 5% of the total observing time is spent on NEO-specialized observing. This is what is currently planned. By increasing this fraction of NEO-specialized surveying to 15% and by running the survey longer, the Congressional mandate of 90% completeness for NEOs of 140m and greater size can be fulfilled after 12 years of operation, with 60% completeness level reached after only 3 years. These specialized observations would be of limited use to other science programs, and they require 15% of the observing time.

The current cost estimate for LSST in 2006 dollars is $389M for construction and $37M per year for operations. For a 12-year long survey, 15% of the total cost is $125M. Thus, we could deliver the performance of a full NEO-dedicated LSST to NASA at a small fraction of the total cost to build and operate such a system. This cost is equivalent to 30% of operations, which would commence in 2014.

Note that by operating LSST in this special NEO-enhanced mode we would have the performance equivalent of an LSST fully dedicated to NEO surveying. By supporting only 15% of the total cost, NASA would be essentially getting a NEO-dedicated LSST. This is a key new insight relative to the costing model in the 2006 NASA NEO report to Congress.